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Deploy workloads in the cloud

Manage your public cloud infrastructure

Understand the value of IaaS

Lawrence Miller, CISSP

2nd Oracle Special Edition

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Introduction

To succeed in today's competitive reality, businesses need to free themselves from the limitations of legacy IT infrastructure. The days of purchasing hardware and maintaining massive data centers to run IT must come to an end. Managing and maintaining your infrastructure is simply too expensive.

According to the RightScale: 2018 State of the Cloud Report, in 2018, 38 percent of enterprises saw public cloud as their top priority (up from 29 percent in 2017). Utilizing an infrastructure with an elastic, pay-as-you-go service model not only reduces costs and worries, but also frees IT organizations to innovate in ways that will enhance business growth.

Foolish Assumptions

It has been said that most assumptions have outlived their uselessness, but I assume a couple things nonetheless:

- You work as a CIO, CTO, SVP, VP, director, or enterprise architect, and you're responsible for some or all IT infrastructure components (such as compute, storage, and networking) in an enterprise that has already adopted — or is currently developing — a cloud computing strategy.

» You have some familiarity with popular public cloud offerings, such as Amazon Web Services (AWS) and Microsoft Azure, but you're less aware of Oracle's cloud and portfolio of enterprise solutions.

Icons Used in This Book

Throughout this book, I occasionally use icons to call out important information. Here's what to expect.


REMEMBER

This icon points out information you should commit to memory.


TECHNICAL STUFF

This icon explains the jargon beneath the jargon.


TIP

This icon points out helpful suggestions and useful nuggets of information.

Beyond the Book

There's only so much I can cover in 64 short pages, so if you find yourself at the end of this book thinking, "Where can I learn more?," just go to `www.oracle.com/iaas`. There, you can learn more about IaaS and the Oracle Cloud Infrastructure. You can give IaaS a try at `http://cloud.oracle.com/tryit`.

IN THIS CHAPTER

- Getting started with a few cloud definitions
- Addressing enterprise workload requirements
- Realizing cost and convenience benefits in IaaS
- Discovering the Oracle Cloud Platform

Chapter 1
Challenges and Opportunities

In this chapter, you learn about the basics of IaaS and cloud computing, what defines an enterprise workload, and the value IaaS provides to businesses seeking to deliver more innovation and agility in their markets.

Defining Cloud Computing Fundamentals

The "cloud" has recently become a part of our modern IT lexicon, and there are many definitions and distinctions of different cloud deployment and service models. To try to cut down a bit on the *cloudwashing* (a term Gartner uses to refer to the marketing practice of adding the word *cloud* to practically any technology product or service), let's keep it simple.

There are five essential characteristics of the cloud (as defined by the National Institute of Standards and Technology, or NIST):

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

There are three basic cloud deployment models:

- Public
- Private
- Hybrid

Finally, there are three basic cloud service models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

A key difference between SaaS, PaaS, and IaaS is the level of control that the enterprise has in the cloud stack. The demarcation line for IaaS is typically at the operating system: The cloud provider manages the virtualization, servers, storage, networking, and data center, while the enterprise is responsible for configuring and maintaining software at the operating system layer and above, including middleware, runtime environments, data, and application software (see Figure 1-1).

Second-generation IaaS offerings extend customer control deeper into the cloud stack, with the option to manage virtualization, servers, and storage, while simultaneously offering higher levels of predictable performance, control, and security than first-generation IaaS platforms. Whereas first-generation IaaS offerings provide cloud-based virtual machines (VMs) in a multitenant environment (meaning several customers may share resources on the same server, while only being able to access the portion of the server that is allocated for their usage), second-generation IaaS offerings can additionally provide on-demand, single-tenant "bare metal" machines (each physical server is dedicated solely to one customer).

TIP

You learn more about second-generation IaaS offerings in Chapter 2.

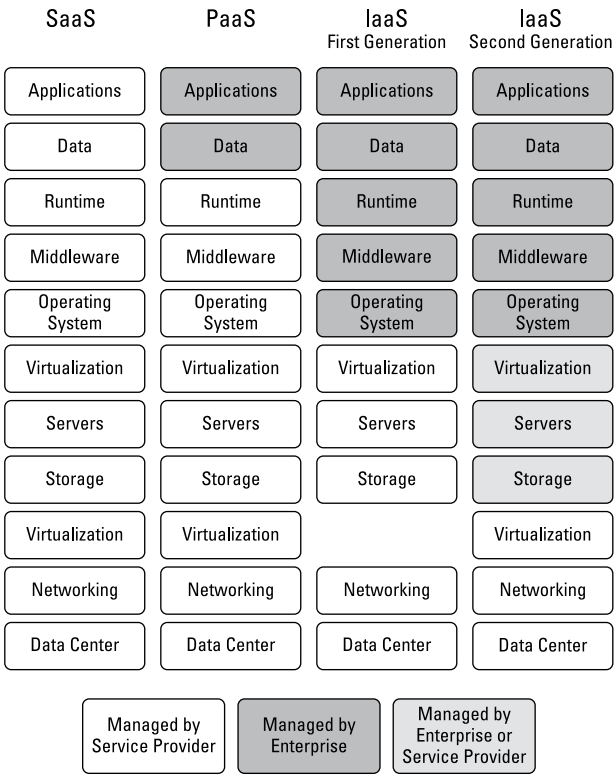

FIGURE 1-1: Different cloud service models provide different levels of control for the enterprise.

Characterizing the Enterprise Workload

Enterprise applications run the business. They range from core mission-critical systems to customer relationship management to social and mobile platforms, to name just a few. Every business is different, but at a very high level, common expectations for enterprise workloads in the cloud include the following:

- **Elasticity and massive scalability:** No resource is infinite or unlimited, but a world-class cloud service provider has more available capacity than enterprises, so resource utilization can be perfectly balanced in the cloud, where you can automatically scale up, out, and down as needed (provided you've architected your applications appropriately).
- **Predictability:** Enterprises are constantly tweaking infrastructure to provide consistent performance for their mission-critical applications. Though many first-generation IaaS cloud platforms don't offer this capability, it's key to successfully running enterprise workloads in the public cloud.
- **High performance:** Enterprise applications typically require very low latency, high throughput, and high input/output operations per second (IOPS).

- **Open standards and workload/data portability:** In the cloud, there are no industry standards governing things like application programming interfaces (APIs), management, and orchestration. Thus, some clouds are quite proprietary and you risk getting "locked in" with a single provider. Also, with some providers, although it's relatively easy to move your applications and data to the cloud, moving them (or even the data they utilize) back can be very difficult if your cloud strategy or needs change.
- **Security and trustworthiness:** There are many layers to security in the cloud that need to be considered, and enterprises must feel confident that their workloads and data are secure.
- **Service-level agreements (SLAs):** SLAs vary widely in terms of the uptime and performance guarantees, as well as the remediation provided should an SLA violation occur.

Enterprises also expect to be able to extend their governance models to the public cloud. IT leaders have been managing on-premises environments for years. They require visibility into who is accessing which resources and when, and they're accustomed to delegating permissions and granting access to resources. Systems of record and governance simply do not change overnight. Your

cloud provider should offer the ability to extend governance to the cloud natively with the following capabilities:

- **Identity and access management (IAM):** Authorize who can perform specific actions on specific resources, with full control and visibility to centrally manage cloud resources.
- **Role-based access controls (RBAC):** Different levels of controls for providing access to various types of infrastructure resources at the account, sub-account, or resource level.
- **Resource visibility:** When IAM and RBAC are utilized and resources are logically defined, a unified view of permissions and security policies becomes available to IT administrators.
- **Quotas:** Limit which resources are available and when, based on specific criteria defined by the organization.
- **Showback/chargeback:** Audit trails allow infrastructure usage costs to be allocated to departments, business units, or individual users.

Understanding the Value of IaaS in the Enterprise

The motivations for businesses to adopt IaaS are diverse, and can be broadly organized as follows:

- **Reducing dependence on the corporate data center:** Moving centralized IT workloads off-premises and lowering or eliminating the need to manage facilities and infrastructure
- **Using IaaS for specific initiatives:** Responding to line of business requests for on-demand infrastructure to support new application initiatives
- **Developing cloud-native applications:** Developing and deploying new applications using native cloud infrastructure capabilities and more agile technologies like containers

IaaS provides increased speed and agility by offering on-demand, self-service access to compute, storage, and networking resources in the cloud. Developers and application owners can get access to infrastructure to run their applications in minutes, and the cloud provides resource elasticity to scale up and down, providing significant flexibility that isn't typically possible in an on-premises environment. IaaS can enable significant IT

cost savings by reducing hardware and data center management overhead while offering a pay-only-for-what-you-use pricing model. This is in contrast to procuring hardware for peak capacity requirements and paying for idle capacity that is underutilized during nonpeak times.

Introducing Oracle Cloud Infrastructure

Enterprises need a cloud environment that replicates their on-premises data center environment — whether for business applications, mission-critical databases on a dedicated cluster, or a fully integrated and managed solution — while also providing all the benefits of the public cloud.

Oracle Cloud Infrastructure (OCI) lets enterprises manage their cloud-based workloads in the same way they do their on-premises workloads, and many existing on-premises applications can be quickly migrated without making changes to the applications themselves.

In the Oracle Cloud, organizations get all the benefits of the cloud with the same control, isolation, security, and predictable performance as their on-premises data centers.

Oracle's IaaS offering includes the following types of services:

- **Compute:** Whether a workload requires a single VM or demands the high performance, consistency, and isolation offered by bare-metal servers, Oracle offers the broadest spectrum of cloud compute options available in the industry today. Oracle's compute options include VMs, bare-metal instances, dedicated compute, and Oracle Cloud at Customer (cloud services behind the customer's firewall), complemented by migration and provisioning tools designed to expedite the migration of Oracle Applications to the cloud.
- **Storage:** Secure and scalable cloud-based storage solutions ideal for storing and accessing data from any environment connected to the Internet. Offerings include local Non-Volatile Memory Express (NVMe) flash storage, network file storage, network block storage, object storage, archive storage, database backup storage, data transfer service, and even a software storage gateway.
- **Network:** Any on-premises data center can be connected to OCI via VPN or FastConnect, allowing organizations to have a private, secure, high-bandwidth, dedicated link between their on-premises data center and the Oracle Cloud.

Oracle Cloud Infrastructure provides comprehensive networking and load balancing capabilities. Oracle's Virtual Cloud Network features enable organizations to deploy highly available, secure network topologies and match on-premises setups, thus not having to rewrite networking specifications within applications.

- **Edge and connectivity:** Oracle also provides network edge services such as DNS. To enable hybrid deployments, Oracle offers dedicated connectivity between Oracle cloud regions and on-premises data centers via FastConnect, and secure Internet connectivity via VPN services.
- **Containers:** Oracle offers a production-grade environment to run container-based applications. Whether customers want to bring their own infrastructure or leverage Oracle's managed Kubernetes service, applications can benefit from the high-performance, highly available infrastructure.

TIP

According to 451 Research, "There is now a strong public cloud option for almost every kind of application and computing workload. An entire generation of IT talent has now effectively grown up with the IaaS model." Whether your business is already headed to the cloud or not, it's a safe bet that your competition is!

IN THIS CHAPTER

- Calculating compute choices
- Weighing storage options
- Selecting network services

Chapter 2
Exploring Oracle Cloud Infrastructure

In this chapter, you learn about the capabilities, features, and competitive differentiators of Oracle's IaaS offerings, called Oracle Cloud Infrastructure (OCI).

Oracle Cloud Infrastructure Compute

The Oracle Cloud offers a variety of compute options to suit your organization's needs with a resilient infrastructure service that provides rapidly provisioned virtual and bare-metal machines in multitenant and single-tenant configurations, respectively. Oracle Cloud at Customer compute solutions (discussed later in this chapter) can be hosted on a customer's premises or in the customer's data center.

REMEMBER

In the cloud, a *single-tenant environment* is a host machine dedicated entirely to a single customer, whereas a *multitenant environment* is a host machine in a virtual machine model that often hosts multiple customers.

Many factors must be considered when determining which compute options are right for your organization's needs:

- **Available CPU sizes:** How much processing power do your applications and workloads require?
- **Available GPUs:** How much graphical processing power do your workloads require?

- **Metered versus unmetered pricing:** Do you need a "pay-as-you-go" option or the option to pay for unlimited usage over a specific period?
- **Single tenant or multitenant:** Do your security and compliance requirements necessitate infrastructure that is dedicated solely to your organization?
- **Migration of KVM/VMware workloads:** Do you need to migrate KVM/VMware dev/test or demo workloads off premises?
- **Hosted on-premises:** Do you need an entire rack of dedicated hardware (fully managed and serviced) in your own data center?
- **Support for containers:** Are your developers actively writing next-generation applications utilizing Docker as their primary container?

TIP

Table 2-1 will help you match the best Compute Service options to your organization's needs, based on your answers to the preceding questions.

I cover your Compute Service options in the following sections.

TABLE 2-1 Compute Service Options

	Virtual Machines	Bare-Metal Compute	Dedicated Compute	Oracle Cloud at Customer
Available OCPU sizes	1–24	36, 52	500–2,000	288+
Available GPUs	2	2, 8	NA	NA
Metered	Yes	Yes	No	No
Single tenant	No	Yes	Yes	Yes
KVM/VMware workload migration	Yes	Yes	No	No
Hosted on customer premises	No	No	No	Yes
Suitable for containers	Yes	Yes	No	Yes

Oracle Cloud Infrastructure Compute

By moving the virtualization layer off the server and onto the network (referred to as "off-box virtualization"), bare-metal instances avoid the *hypervisor tax* (the performance degradation or overhead typically associated with virtualized compute infrastructure offered by first-generation cloud providers), thereby enabling extremely high levels of raw and consistent performance — comparable to dedicated on-premises servers.

Oracle provides two compute offerings for flexibility to run your most demanding workloads, as well as less performance-intensive applications, in a secure and highly available cloud environment:

- **Bare-metal instances:** For I/O-intensive web applications (such as real-time analysis) or big data workloads (such as batch processing), bare-metal servers are an ideal match. Oracle provides a fully dedicated bare-metal server on a software-defined network, combining the power of bare-metal servers (physical servers assigned to only one customer) with a secure, isolated Virtual Cloud Network (VCN, described later in this chapter). Bare-metal servers provide extreme raw performance, including servers with the latest generation Non-Volatile Memory Express (NVMe) drives delivering stellar input/output per second (IOPS).

- **Virtual machines:** For workloads that don't require dedicated physical servers or the extreme performance of bare metal, VM instances are offered in different sizes, supporting many common workloads. VMs are offered with local NVMe storage (with optional network block storage), or network block storage only.
- **GPUs:** GPU compute, which are optimized for workloads like high-performance computing (HPC) and machine learning, are available as bare-metal instances or virtual machines. GPU compute is offered with different numbers of GPUs, different numbers of CPUs, and network block storage.


TIP

Choose bare-metal compute instances when single-tenancy is important and you need the highest performance and resilience for your production workloads.

Oracle Cloud Infrastructure Container Service for Kubernetes

Containers make it easy for developers to build and deploy apps by providing preconfigured application environments, including dependencies, rather than requiring developers to re-create application environments every time they stand up a new server. With containers, developers can set up an application environment once (or use a preconfigured environment) and use it across as many

containers as needed. Oracle's container service is designed for DevOps teams to build, deploy, and operate container-based applications using open-source tools. It includes a managed Kubernetes service for creating and managing clusters, a private registry for storing and sharing container images, all powered by enterprise-grade cloud infrastructure.


TIP

Use Container Service when you're building and deploying container-based applications.

Oracle Ravello Service

Many businesses today are running significant portions of their on-premises workloads in VMware or KVM virtualized environments and looking to extend those workloads to the cloud. Ravello enables enterprises to run their VMware and KVM dev/test workloads "as is" in the public cloud, without any modifications. With Ravello, enterprises don't need to convert their VMs or change networking configurations. This capability enables the business to rapidly deploy existing applications on the public cloud without the associated infrastructure, migration costs, and overhead.


TIP

If you've been running VMware or KVM-based dev/test workloads on-premises, or even at another cloud provider, use the Ravello Cloud Service to quickly migrate these workloads to Oracle Cloud Infrastructure.

Oracle Dedicated Compute Service

Oracle Dedicated Compute Service is a dedicated, high-CPU environment in the Oracle Cloud that consists of high-performance x86 servers reserved for your use to run mission-critical applications with predictable, consistent performance and network isolation. With Dedicated Compute Service, you can set up databases using the Oracle Database Cloud or Exadata Cloud Service. Dedicated Compute Service is also available for SPARC-based customers that require a single-tenant environment.

TIP

Choose Dedicated Compute Service when you require maximum control for running legacy workloads with very high processor requirements.

Platform services

Combine OCI services with Platform as a Service (PaaS) offerings like Database Cloud Service to provide integrated building blocks for enterprise applications. Current PaaS services integrated into OCI include: Java CS, DataHub CS, BigData (CE) CS, SOA CS, Integration CS, Analytics CS, GoldenGate CS, Application Container, Data Integration Platform, Autonomous Data Warehouse Cloud, and Visual Builder CS.

Oracle Cloud at Customer

Oracle Cloud at Customer brings the Oracle Cloud to your data center, allowing you to retain full control over where your data and applications reside. Based on the same PaaS and IaaS software found in OCI Classic, this service provides one platform to develop, deploy, and manage Oracle and third-party workloads. Write applications once and choose whether to deploy them on- or off-premises. An Oracle Technical Account Manager and an entire suite of operational tools and support are provided with this service.


TIP

Deploy Cloud at Customer to get the benefits of a fully managed cloud on-premises in your data center. Oracle manages the entire implementation and provides ongoing operational support, including a dedicated point of contact.

Oracle Cloud Infrastructure Storage

All organizations back up and archive their data. Oracle offers a wide spectrum of storage and database solutions designed to meet your specific data requirements. I cover your options in the following sections.

Local NVMe storage

NVMe flash drives provide the highest-performance storage, with millions of IOPS for compute instances in the Oracle Cloud. Local NVMe storage shapes are offered in 12.8 and 28.8 terabyte (TB) options.

Block Volumes

All-flash Block Volumes offer high-speed network storage capacity with seamless data protection and recovery. Network-attached Block Volumes deliver low latency and tens of thousands of IOPS per compute instance. Utilizing up to 32 32TB block volumes offers consistent high-performance and scalable capacity as your data needs grow.


TIP

Oracle Database Cloud Service can be run on bare-metal compute with NVMe, or on VMs with network block storage.

File Storage

OCI File Storage is a fully managed, persistent shared file system. With just a few clicks, companies can create and mount a file system accessible by a handful, or thousands, of compute resources within a region. This service supports NFSv3 and most third-party on-premises appliances, offering a seamless way to manage files in the cloud.

Object Storage

Object Storage offers virtually unlimited amounts of capacity, automatically replicating and healing data across multiple fault domains for high durability and data integrity. Running on the same low-latency network as compute, the object storage service also provides a Hadoop Distributed File System (HDFS) interface for big data and data lake use cases.

Archive Storage

The OCI Archive Storage service provides cost-effective archive storage for infrequently accessed, large-scale data sets, long-term data retention, rich media content, and scientific research archives, with enterprise-grade security, resilience, and elastic scalability. Elasticity and scalability are coupled with pay-as-you-go and subscription-based models, so you can choose to pay only for what you use or take advantage of reduced rates for longer commitments. You can monitor key storage metrics and manage users and roles using a web-based graphical console.

Storage Software Appliance

OCI Storage Software Appliance is a cloud storage gateway that is installed on-premises and then used to easily connect applications and workflows to the Oracle Cloud.

Database Cloud Service

OCI's Database Cloud Service is optimized for Oracle Databases. Supported versions include 11g, 12c, and 18c and the recently announced Autonomous Data Warehouse. Databases can be run on bare-metal or virtual machines in real application cluster (RAC) configurations or on Exadata, where DBs can be deployed in multiple availability domains with Active Data Guard for high availability.

Database Backup Service

The OCI Oracle Database Backup Service is a reliable and scalable object storage solution and data protection service designed for the unique needs of Oracle Database customers. It provides direct, cost-effective integration with Oracle Recovery Manager (RMAN) so you can take advantage of cloud-based data protection with your current IT processes and staff.

Oracle Cloud Infrastructure Networking

Networking services provide organizations with connectivity *to* the cloud and *in* the cloud. In Chapter 3, you learn how to securely connect your organization to OCI with Oracle FastConnect and Oracle VPN. An Oracle Virtual Cloud Network (VCN) extends your IT infrastructure into

the Oracle Cloud with highly customizable private networks. A VCN is a private network that you set up on OCI, with firewall rules and specific types of communication gateways that you choose. Within this network, you launch your virtual instances or access bare-metal (single-tenant) resources.

Just like a traditional data center network, a VCN provides complete control over your network environment. You can customize your VCNs to mirror your internal networks, or build new network topologies with granular control, including assigning your own private IP address space, creating subnets, creating route tables, and configuring stateful firewalls. A single tenant can have multiple VCNs, thereby providing grouping and isolation of related resources.

Key VCN features include the following:

- **Customizable VCNs:** Fully configurable IP addresses, subnets, routing, and firewalls support new or existing private networks for rapid flexibility and scalability.
- **End-to-end security:** Multiple security layers, including packet encapsulation, in-flight encryption, and IPSec VPN connectivity.

- **High performance:** A high-bandwidth, micro-second latency network enables high performance. Oracle's flat network design limits the number of "hops" (a hop occurs when network traffic traverses a device such as router or switch), which permits real-time application workload processing (such as batch jobs and applications requiring real-time querying).
- **High availability:** Active and passive logical and physical network redundancy.


REMEMBER

Oracle's OCI Compute, Storage, and Network Service offerings provide customers with choice and flexibility to run their enterprise workloads in a scalable, fast, predictable, and resilient platform in the public cloud.

IN THIS CHAPTER

- Looking at options for connecting to the cloud
- Recognizing the need for a dedicated connection
- Leveraging a virtual private network over the Internet

Chapter 3
Connecting to Oracle Cloud Infrastructure

Oracle Cloud Infrastructure (OCI) offers connectivity options with high-throughput, enterprise-grade security, and performance predictability, enabling your cloud workloads to deliver business results. In this chapter, you learn about your options for connecting your enterprise to the Oracle Cloud.

Enterprise Requirements for Connecting to the Cloud

When extending your enterprise workloads to the cloud, how you connect your on-premises environments to the cloud matters. The challenge for enterprises is to find a path to the cloud that meets current needs, preserves the usefulness and value of their existing investments, and provides options for the future. Technical challenges for connecting to the cloud include the following:

- The Internet is shared, unpredictable, and public.
- Applications that consistently need to transfer large volumes of data require higher sustained networking bandwidth than others.
- Many applications are sensitive to network latency.

Enterprises are looking to cloud providers to offer access to computing resources that behave as if they're simply extensions of their own corporate data centers. In connecting on-premises data centers to cloud, two key considerations are data transfer speed and security. OCI offers solutions to meet both needs (see Figure 3-1):

- **Oracle FastConnect** links your data center and the Oracle Cloud, using a direct, private connection (circuit) provided by a dedicated networking partner (network service provider).

» **Oracle VPN** is a virtual private network (VPN) connection that links your data center and the Oracle Cloud, using an encrypted tunnel over the public Internet.

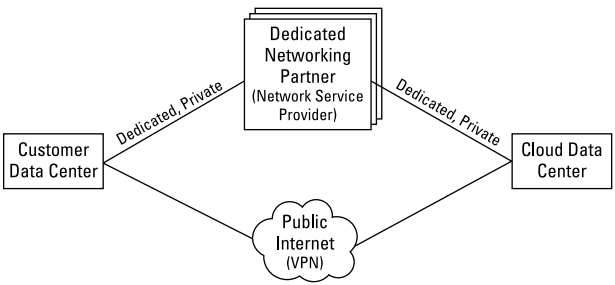

FIGURE 3-1: Two options for connecting on-premises to the cloud.

TIP

VPN solutions typically offer a lower-cost alternative, but a dedicated private network is a better choice for businesses that transfer high volumes of data over dedicated connections.

Oracle FastConnect

Oracle FastConnect extends enterprise workloads via a dedicated connection between your data center and the Oracle Cloud. To set up FastConnect, you provision a private, dedicated circuit from your network service provider (such as AT&T, CenturyLink, Verizon, and others)

to connect your locations and/or data centers to the Oracle Cloud.

The most common use cases for FastConnect (or any dedicated private circuit for that matter) include the following:

- **Bidirectional transfer of large volumes of data (batch jobs):** The unpredictable nature of the Internet often results in significantly lower batch job performance, or batch jobs not completing in time due to latency issues beyond your control. FastConnect overcomes this problem by moving traffic over a dedicated path, thus allowing batch processing to occur at the speed required by your applications.
- **Applications that require consistent latency and network performance:** Many enterprise applications are very sensitive to latency and any variations in latency. Applications often time out when the underlying request made by the application fails to get a timely response, due to latency somewhere in the network. If your application requires real-time, or very near real-time, responsiveness you need a dedicated, private networking solution like FastConnect.
- **Sensitive data transfers that can't traverse the public Internet:** If your data must never leave trusted boundaries, then a direct connection is

needed. Although data can be encrypted over the Internet, it can still take unexpected hops (for example, to a router in a foreign country) on its way to its destination. A dedicated connection like FastConnect provides a direct, secure connection (with optional encryption for additional security) from one endpoint to the other.


TIP

Use a dedicated connection (like FastConnect) if you transfer large volumes of data over your network, have an application that requires consistent (and/or low) latency, or have sensitive data.

Key FastConnect features include the following:

- **Multiple port speeds:** You can choose port speeds ranging from 100Mbps to 10Gbps, depending on your use case and the amount of data you expect to transfer on a monthly basis. Choose the option that corresponds to the amount of traffic your applications produce to maintain the optimal balance between cost and throughput.
- **Standard Layer 3 routing:** FastConnect leverages industry-standard Border Gateway Protocol (BGP) routing to manage the exchange of data between the Oracle Cloud and your network. BGP offers many benefits, but perhaps the most important features are that it automatically finds the fastest

route for your data to travel from one point to another, and it allows you to advertise routes across other provider networks so you can leverage two different network service providers (such as AT&T and Verizon) for network resilience.

- **Redundancy:** FastConnect can be configured as a fully redundant service with two physical connections from your network edge to the Oracle Cloud Platform network edge for high availability.

TIP

Knowing how much data your application generates is imperative. There are lots of third-party software tools you can use to accurately measure and monitor the amount of data your applications generate. With Oracle FastConnect, you aren't charged for the amount of data transferred; instead, you pay only for the port speed you've chosen.

If your enterprise data center happens to be in one of the same data centers as the Oracle Cloud, FastConnect enables you to access and manage your Oracle Dedicated Compute Service as an extension of your private network. Oracle is continuing to expand its number of dedicated networking partners, including: Aryaka, AT&T, BT, CenturyLink, Digital Realty, EdgeConneX, Equinix, InterCloud, Level3, Megaport, NexDC, NTT, Orange, Sohonet, Tata, and Verizon.

REMEMBER

Some important factors that affect network latency include the distance between your data center and the Oracle Cloud, as well as the connectivity type. Cost is driven by the speed of your network service provider's circuit and the Oracle FastConnect port speed that you choose.

Oracle VPN

A VPN creates an encrypted connection to another network over the Internet using the IP Security (IPSec) protocol. Benefits of a VPN include the following:

- Lower cost than dedicated private connections
- Ease of implementation
- Flexible deployment to any location

However, there are some important drawbacks associated with VPNs that an enterprise must consider:

- Variable bandwidth
- Lower reliability (relies on the availability of the public Internet) than dedicated private connections

- Higher latency (inherent on the public Internet) than dedicated private connections

Thus, VPN connections are appropriate for enterprises that have highly fluctuating data requirements, or relatively low data volumes.

Oracle offers a site-to-site IPSec VPN for enterprises to securely connect their data centers to the Oracle Cloud Platform. Key Oracle VPN for Compute features include the following:

- **Data encryption:** 256-bit Advanced Encryption Standard (AES) encryption is used to secure data between an enterprise's data center and the Oracle Cloud.
- **Configurable pre-shared key:** Symmetric key encryption using a pre-shared key enhances security and overall performance. Enterprises can manage and change their own keys.
- **Multiple tunnels:** Enterprises can set up multiple tunnels within the Virtual Cloud Network (see Chapter 2). This can be useful if you need to isolate a specific network path for certain traffic. For example, you might define a private network tunnel for an application calling back to a database to gather specific customer data, and that tunnel is never accessible from the Internet.

- **Configurable subnets:** Enterprises can configure a range of IP addresses for compute instances. This allows you to group virtual instances and/or create multiple groups of instances, all with predefined IP addresses.
- **Built-in redundancy:** Enterprises can benefit from utilizing multiple VPN connections to ensure redundancy and availability.
- **Third-party hardware VPN support:** Oracle VPN supports many of the third-party VPN solutions that enterprises often deploy.

REMEMBER

There are two primary methods for extending your workloads to the Oracle Cloud. You can utilize a direct private, dedicated connection (Oracle FastConnect), or you can choose to route encrypted traffic over a VPN (Oracle VPN). When you're connected to the Oracle Cloud, you can leverage Oracle Virtual Cloud Network (VCN, discussed in Chapter 2) to customize your private network and the extremely high performance, predictability, and availability of Oracle's flat network design (see Chapter 5).

IN THIS CHAPTER

- Leveraging high performance in the cloud
- Keeping your archives in the cloud
- Working with cloud-native applications
- Taking your on-premises data center to the cloud
- Looking at lift and shift use cases

Chapter 4
Examining IaaS Use Cases and Success Stories

In this chapter, you learn about common IaaS use cases and how customers are using Oracle Cloud Infrastructure (OCI) to address real-world challenges and achieve their strategic goals.

Moving Your Data Center to the Cloud

Managing a data center is costly for any business, and it shifts IT resources away from strategic business priorities. Reducing dependence on a corporate data center by moving workloads to the cloud allows your IT team to focus on more strategic business priorities instead of procuring and maintaining infrastructure.

Read the nearby sidebar to learn how Darling Ingredients eliminated its dependence on its data center by migrating its key enterprise apps to OCI.

DARLING INGREDIENTS

Darling Ingredients is the world's largest producer of sustainable ingredients. Operating in more than 200 locations across five continents, the company aims to turn natural bio-nutrient residuals into necessary resources.

Challenges

Darling Ingredients was housing its aging infrastructure in a colocation facility. With its critical systems showing signs of wear, and its colocation contract coming up for renewal, Darling

wanted a way to modernize its approach — without introducing new costs.

Solutions

Darling chose to move its IT infrastructure into the OCI, and it can now get the reliability and high performance its applications demand — while also minimizing maintenance requirements and costs. Oracle E-Business Suite (EBS), Oracle Database, Oracle Hyperion, and related Oracle applications, along with third-party applications such as Informatica, Vertex, and its Laboratory Information Management System (LIMS) are all moving as part of this project.

Results

- Performance that doubles the previous hosted solution
- Predictable, high-bandwidth connectivity between applications hosted in the cloud and application end users
- Tremendous efficiency gains: Deployment included consolidation from 19 to 3 database systems

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- Predictable costs and transparent pricing
- A true hybrid cloud, rooted in bare metal, easing application migration

According to Tom Morgan, the Oracle Apps DBA Manager for Darling Ingredients, "Darling Ingredients has had an aggressive plan to move all of our key IT applications into the cloud. We have a number of critical Oracle applications, many of which rely on Oracle Database. Oracle Cloud Infrastructure Database on bare metal met our stringent performance requirements. Having predictable, high-bandwidth connectivity to our end users is critical, and Oracle FastConnect was a great solution."

Utilizing High-Performance Computing

Some of the most difficult workloads to successfully execute in the public cloud are those that require massive amounts of dedicated computing power (CPU cycles). Often "noisy neighbors" in a multitenant environment will limit the amount of CPU an application can use. OCI offers single-tenant options where servers are dedicated entirely to one customer and, thus, CPU cycles are never compromised.

YELLOWDOG

YellowDog provides a 3D animation rendering service that uses a combination of crowd-sourced and public cloud provider computing resources to create a virtual supercomputer for animators.

Challenges

Rendering 3D animation files into digital media is an intensive computational process. Traditionally, this process consumes from tens to thousands of hours of compute time. YellowDog's business goal is to revolutionize the rendering process and turn around large workloads in minutes to hours.

Solutions

By harnessing the power, availability, and scalability of bare-metal servers on OCI, YellowDog has built an innovative service business that leverages cloud-based high-performance computational processing.

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Results

Gareth Williams, YellowDog CEO and founder, summarized YellowDog's success implementing the Oracle Cloud in this way: "The high-performance, nonblocking VCN ensures reliable, high-bandwidth connections between workers providing on-premises-like performance in the public cloud framework, to make our clusters scale up or down depending on the workload requirements. Running six bare-metal Oracle servers in the Oracle Cloud was from 2 to 9.8 times more effective than using virtual machines in other public clouds when it comes to the task of 3D rendering."

Williams continues, "The availability of high-power machines is not always what is advertised, and when we have used other public cloud providers, we've sometimes stretched their operational capability. We benchmarked Oracle Cloud against our production deployment, using bare-metal servers on OCI with fantastic results that blew anything we had previously used out of the water. The Bare Metal benchmark was twice as fast as any other instance we have running in our production environment, with one result nearly ten times faster than our production instance. We are very

pleased with the results and have been very impressed since we started working with the Oracle Cloud team — their responsiveness, agility, and make-it-happen attitude [are] brilliant."

Building and Deploying Cloud Native Apps

Many businesses are turning to the public cloud to support Agile application development methodologies and DevOps environments. IaaS provides development teams with the most control of infrastructure in the public cloud, without requiring extensive hardware knowledge, and rapid, self-service provisioning with "pay-only-for-what-you-use" subscription-based pricing enabled DevOps environments.

LINKD

Linkd is a SaaS development firm that built a web and mobile project management platform for the architecture, engineering, and construction (AEC) industry. Linkd's platform enables the construction, real estate, and manufacturing

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industries to make better-informed decisions using an advanced technology stack with artificial intelligence (AI) and augmented reality consolidating different point solutions into one collaboration platform.

Challenges

Linkd needed a cloud infrastructure responsive and performable enough to run its MEAN (Mongo, Angular, Express, NodeJS) application as its customer base grows.

Solutions

Linkd implemented a combination of bare-metal Dense IO instances, virtual machines, block and object storage, and load balancing services.

Results

Linkd experienced 6x file read and write operations per second versus three other providers as well as 6x throughput.

According to Todd Robertti, CTO and founder of Linkd, "The speed of deployment of servers was ridiculously fast — faster than anything else I've

seen — and I've tried all the major cloud providers as well as some smaller ones. When things go wrong — and sometimes they do — you need to take action quickly and deploy new resources. It can take two days to deploy a new bare-metal server with some providers. I've done it in two minutes with Oracle."

Archiving in the Cloud

Archiving in the cloud is an ideal use case for IaaS, because it enables organizations to securely and cost-effectively store their long-term archive data offsite, while keeping it readily accessible when needed. Cloud-based archiving provides economies of scale when archiving large quantities of data (with a tiered pricing structure), and organizations enjoy peace of mind knowing that the massive scalability inherent in the cloud will accommodate their data needs as they grow over time.

Learn how Tippett Studio leverages OCI for cost-effective and massively scalable archives in the following Oracle customer story.

TIPPETT STUDIO

Tippett Studio was founded in 1984 by Phil Tippett, just after he had received his first Academy Award for his work on *Return of the Jedi.* Today, Tippett Studio is a high-end character and creature animation media production company.

Challenges

The studio's primary medium used to be cinema, but today it also creates effects for endpoints from IMAX screens to mobile phones. As demand for visually richer experiences on more diverse viewing platforms has increased, so too has the demand for more sophisticated and robust technology.

Solutions

Tippett Studio evaluated several IaaS options. When it looked at Oracle Cloud's storage offerings, it was impressed with the price and scope of the offerings.

"What appealed to me was the structure of the storage solutions that Oracle was providing," says Sanjay Das, Tippett Studio's CEO. "There were two tiers. The first tier is what they call

the object store, where you have instant access to the data that you put in the cloud into your active production. And then you have the second tier, the archive store or the archive tier. Those tiers work well for us because we have so many films that we've worked on and still need to maintain for a number of years — the data and all the images."

Tippett Studio implemented the Oracle E-Business Suite with Oracle Compute, Storage, and Database Cloud Service. Now, movies that it hasn't worked on for more than five years go into the archive store, while movies that the company has worked on within the last five years go into the object store. This two-tier system allows the studio to quickly access and repurpose content, and it also provides disaster protection — especially important as the studio expands its distribution and operations globally.

Results

The storage costs in the Oracle Cloud were ten times less than other public cloud solutions. Says Corey Rosen, Tippett Studio's VP of Creative Marketing, "Oracle Cloud won by a mile. The affordability, the accessibility, and really the stability of Oracle Cloud stood out beyond everything else, and to us, it was a no-brainer."

Lifting and Shifting Applications to the Cloud

"Lifting and shifting" refers to moving a workload (virtual machine or application) from an on-premises data center to the cloud, without making any changes to the workload. Many companies find that lifting and shifting existing workloads to the cloud enables IT to be more responsive to the business.

Read the nearby sidebar to learn how ironSource lifts and shifts replicas of its customer environments to the cloud to enable rapid and accurate quality assurance (QA) testing.

IRONSOURCE

ironSource builds monetization, engagement, analytics, and discovery tools for app developers, device manufacturers, mobile carriers, and advertisers. The company has developed a leading application distribution platform, which optimizes and automates the installation process, analytics, and monetization for application developers.

Challenges

ironSource found that developing and testing its installers on all combinations of operating

systems and browsers was extremely challenging and time consuming. Solutions for its trainees were limited and relied on two methods to set up training environments, resulting in static processes that did not scale.

Solutions

Leveraging the ease of replicating customer environments with Ravello, ironSource has created more than 600 replicas of customer environments, which are being used daily for testing. It normally takes less than 20 minutes to build the environments, run the tests, and report the results. At the end of each batch, the environments are then shut down, resulting in a simple "pay-per-use" service and allowing ironSource to drastically reduce costs for the associated infrastructure resources needed to run the tests.

Results

"The overall benefit to ironSource was the ability to scale our QA automation infrastructure. Windows client testing in the public cloud has historically been very difficult, but Ravello has been able to provide a clear, simple solution," says Oded Priva, ironSource R&D Team Leader.

IN THIS CHAPTER

- Delivering performance and predictability
- Leveraging an open and flexible cloud platform
- Ensuring visibility and control
- Optimizing for Oracle applications and databases
- Choosing a complete solution

Chapter 5
Ten Advantages of Oracle Cloud Infrastructure

In this chapter, I describe ten key advantages of the Oracle Cloud Infrastructure (OCI) that enable organizations to migrate and extend their enterprise workloads to the public cloud.

Performance

Application performance is often characterized by latency, input/output operations per second (IOPS), and throughput. Different applications and architectures require different levels of each — at the right cost point. First-generation clouds are primarily hypervisor based and biased toward scale-out applications, thus forcing compromises when attempting to run more traditional scale-up applications, and often requiring a substantial level of rearchitecting or replatforming.

Enterprise back-office applications, high-performance computing (HPC), transactional database applications, real-time analytics, and many other applications require a level of peak performance and predictability that is unavailable in first-generation cloud providers. These cloud providers offer hypervisor-based compute options that are prone to noisy neighbors. OCI is purpose-built to achieve and sustain millions of transactions per second within a single compute instance at a significantly superior price per transaction. Consistent high performance means customers can run mission-critical applications with confidence, and run new high-performance applications they can't run anywhere else.


TIP

OCI is built on servers with local storage providing a cumulative total of more than 5.5 million read and 2 million write IOPS per bare-metal instance.

Predictability

Enterprises have spent many years tuning their on-premises environments to meet the exacting standards of predictability and reliability that their most critical applications require. Unfortunately, early adopters of the public cloud have had to give up much of that hard-earned experience, particularly for traditional scale-up application architectures.

But you don't have to sacrifice predictability to take advantage of the public cloud. Oracle offers the benefits of on-demand access, self-service, and scalability, with the dependability of dedicated resources. Oracle has built a next-generation cloud environment to provide each tenant with compute, storage, and networking capabilities that deliver predictable performance that often matches or exceeds enterprise on-premises environments.

Availability

Oracle is built on an enterprise-grade, fault-tolerant infrastructure that provides high availability with cross-availability-domain replication and recovery. Users first select what region of the world they want to have their workload hosted within — for example, the Western United States. After they've chosen the region, there are multiple data centers — known as *availability domains* (ADs) — within each region in which cloud workloads

can be deployed. Each availability domain is connected by a high-speed network backbone.

This approach to providing worldwide infrastructure availability provides the highest levels of failure protection and availability for the most demanding cloud applications that Oracle Cloud customers deploy and operate.


REMEMBER

Applications are becoming more complex and more distributed, thus elevating your business's need to run on a high-performance, fault-tolerant platform.

Each resource within an AD is connected by a flat network design that minimizes the number of hops, reducing the latency between compute and storage nodes and offering highly consistent performance (see Figure 5-1). Low-latency, high-bandwidth network connections include 25 gigabit per second (Gbps) links between hosts in an AD with less than 100 microsecond (μs) latency.

Oracle ADs are stand-alone structures, each with its own independent and redundant power and cooling systems. At least three ADs, located within approximately 20 to 25 miles of each other, are interconnected with a low-latency network to make up a single cloud computing region.


TIP

A good example of how Oracle's AD architecture can help deliver fault tolerance is databases. ADs provide a fault-tolerant foundation for traditional active/passive and

active/active availability configurations (for example, Oracle Dataguard for Oracle Database).

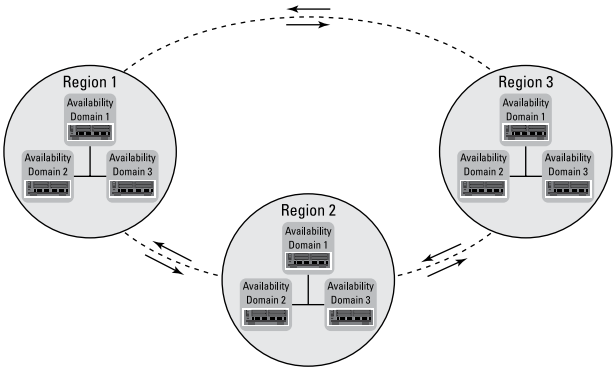

FIGURE 5-1: OCI — regions and availability domains.

Openness

Customers are choosing a variety of technology approaches to meet their needs, often with open-source technologies or custom applications. Oracle's approach to the cloud gives customers the flexibility to run a broad array of applications natively on its infrastructure. Whether it's other types of databases like Apache Cassandra, big data frameworks like Hadoop, or container orchestration technologies like Kubernetes, OCI has demonstrated the capability to run these technologies

natively, with superior performance to other cloud providers. This support of upstream open source, along with the support of a range of programming languages, middleware, major operating systems (OSes), and even hypervisors, demonstrates Oracle's commitment to solving customer problems while limiting lock-in and the associated overhead.

Versatility

Oracle offers the most versatility in the public cloud, allowing companies to run traditional and cloud-native workloads on the same platform, reducing operational overhead and costs, and enabling connectivity and shared data between these workloads.

Oracle provides the broadest variety of deployment options from a single vendor in market today — bare-metal servers, virtual machines, on-premises systems (both traditional on-premises systems and on-premises cloud via Cloud at Customer) — and network connectivity options to enable hybrid scenarios.

Visibility

First-generation cloud providers offered services targeted to cloud-native applications. These environments were ideal for "rogue" or "shadow" application

development efforts (sometimes sponsored by line of business managers), but they didn't do much for the central IT group ultimately responsible for corporate IT governance and systems of record. In many companies, these rogue efforts led to VM sprawl across multiple cloud providers and costs spiraling out of control. Clearly, governance and visibility tools are required to support the enterprise's successful journey to the cloud.

Instead of designing its cloud for individual users, Oracle started with complex organizations in mind, and implemented the logical tools to make resources easier to segregate, provision, monitor, and audit. For example, compartments enable customers to assign access policies, usage quotas, and budget, on a per-project or group basis. IT administrators can manage multiple environments via a single policy and gain visibility into who is consuming what resources. Usage is rolled up under a single account structure, so IT doesn't have to aggregate dozens or hundreds of accounts.

Control

Public cloud services are widespread and growing, but some countries and regions within them don't offer world-class public cloud data centers. Additionally, some enterprises need to run their workloads within their own data centers to meet business, legislative, and regulatory requirements. For example, some companies and

government agencies must keep their application development and data processing behind corporate firewalls to comply with security mandates or abide by data governance and compliance regulations.

To serve enterprises looking for the cloud's agility, automation, extensibility, and portability, in an on-premises environment under their control, Oracle Cloud at Customer places the same hardware, software, and operational services available in Oracle's public cloud directly into enterprise data centers.

Oracle Cloud at Customer is a tightly integrated service designed from the ground up for developing enterprise applications using the same Oracle IaaS and PaaS tools and services that are available in its public cloud, and running those applications either on-premises or in the Oracle Cloud. An extension of the Oracle Cloud, this offering resides completely within an organization's data center, and is fully managed by Oracle.

REMEMBER

Oracle Cloud at Customer makes Oracle's IaaS (including compute, storage, and networking) and PaaS (including Oracle Java Cloud Service, Oracle Integration Cloud Service, Oracle Database Cloud Service, and others) offerings available to enterprises in an on-premises environment, in a subscription model.

Management

Moving to the cloud can also mean changes to the tools and processes you use to manage and maintain your IT infrastructure. There's a good chance you're currently managing both legacy systems and cloud-based assets.

Oracle reduces the pain associated with managing what would typically be two entirely disparate sets of systems — through Oracle Management Cloud (OMC). OMC offers a suite of next-generation integrated monitoring, management, and analytics services that leverage machine learning and big data techniques against the full breadth of the operational data set. It's designed to deliver insights in minutes rather than months.

REMEMBER

OMC's unified platform helps enterprises improve IT stability, prevent application outages, increase agility, and harden security across their entire application and infrastructure portfolio, both on premises and in the cloud.

Scalability

One of the key advantages of the public cloud is massive on-demand scalability. OCI provides enterprises with scale-up and scale-out compute and storage capacity for their most demanding workloads and applications.

Customers pay only for what they use, and can scale down and in when their compute and storage needs change.

ADs (discussed in the "Availability" section) are also excellent for scale-out availability configurations that often require odd numbers of sites for quorums. (A *quorum* is the minimum number of votes that a distributed transaction must obtain to be allowed to perform an operation in a distributed system.) Object (file) storage nodes are automatically and seamlessly replicated across three fault-independent ADs per region. Finally, each AD accommodates up to a million servers with on-demand elasticity and scalability to meet enterprise demands.

Optimized for Oracle Applications and Databases

OCI has a number of unique features and tools that are geared to migrate and/or run Oracle's databases and business applications portfolio with unmatched scalability and reliability. Minimal architecture changes, coupled with automated migration tools, reduce the cost and length of time required to migrate to the cloud.

Proven technologies like Oracle Real Application Clusters (RAC) and Oracle Exadata are supported, retaining best practices and offering the same levels of confidence often experienced on-premises. Furthermore, the latest

hardware and technologies are available, improving database and application performance and results.


TIP

Go to `https://cloud.oracle.com/tryit` to experience the Oracle Cloud Platform with a free trial.

ORACLE CUSTOMERS SHARE THEIR IaaS EXPERIENCES

"Oracle Cloud Infrastructure brings a different level of performance and customizability with access to bare-metal resources. Leveraging those capabilities is crucial to us to maintain the strictest performance requirements to support our research enterprise."

—Chuck Gilbert, Technical Director and Chief Architect, Institute for CyberScience, Penn State University

"We don't need that much hardware all the time, so it would never have been cost-effective to purchase it all. When we started exploring Oracle's cloud, everything just worked — it was easy to get our Java 8 streaming API and Ubuntu environment up and running in minutes. We started in March, and by June we demonstrated the live solution running in real-time, displaying spacecraft trajectories to the audience, selecting and modifying them from a tablet."

—Sean M Phillips, Principal Software Engineer, A.I Solutions

"Darling Ingredients has had an aggressive plan to move all of our key IT applications into the cloud. We have a number of critical Oracle applications, many of which rely on Oracle Database. Oracle Cloud Infrastructure Database on bare metal met our stringent performance requirements. Having predictable, high-bandwidth connectivity to our end users is critical, and Oracle FastConnect was a great solution."

—Tom Morgan,Oracle Apps DBA Manager, Darling Ingredients

"ICAT is in the catastrophe insurance business, so we're very sensitive to risk and business continuity. We've run our mission-critical policy administration application on-premises with Oracle Database for years, but keeping up with business growth was a challenge. The Oracle Database Cloud Service on bare metal exceeded our performance requirements and made a move to the Oracle Cloud feasible. The ability to quickly scale up processing power, as well as leverage Oracle RAC in the cloud, gives us great confidence that we will be able to offer our customers the service and reliability necessary with our new cloud-based system."

—Mike Ferber, CIO, ICAT

"Deployment was quick and simple — we could manage almost everything within a single team. We can fire up a Linux host in one minute, instead of creating a ticket and waiting for manual internal processes to allocate it to physical hardware, configure, deploy it, and notify us of completion. That can take days."

—Jim DeVos, Applications and Database Administrator, Entrust Datacard

Run enterprise workloads on the Oracle Cloud® Infrastructure

To succeed in today's competitive markets, enterprises need to free themselves from the traditional IT infrastructure shackles that hinder business agility and growth. Infrastructure as a Service (IaaS) provides exactly this — on-demand access to IT infrastructure resources in the public cloud. Oracle Cloud Infrastructure offers a scalable, resilient, next-generation infrastructure, purpose-built for running enterprise workloads. *IaaS For Dummies* explains how Oracle offers an unmatched breadth of computing options to suit your needs.

Inside...

- Find out more about IaaS and how it can benefit your business
- Consider common IaaS use cases and real-world business successes
- Discover the benefits of Oracle IaaS and how it is different from the rest

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